Lean and Green

Green Is Good For Business
September 14, 2010

Vivian Harper

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Lean & Green
Lean & Clean
Lean to the Next Level

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- Today's topics:

- Lean overview
- Recognizing green in the non-green
- Lean tools that are "secretly" green
- The green market advantage

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- Introductions

- Lean background?
- Sustainability/green background?

- Bunny lover or tree hugger?

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Definitions

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Defining Lean

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Lean is:

"A systematic approach to identifying and eliminating waste (non-value-added activities) through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection."

— The MEP Lean Network

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Definition of Value-Added

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Value-Added

Any activity that increases the market form or function of the product or service. (These are things the customer is willing to pay for.)

Non-Value-Added

Any activity that does not add market form or function or is not necessary. (These activities should be eliminated, simplified, reduced, or integrated.)

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- Waste
  - "Anything other than the minimum amount of equipment, materials, parts, space, and worker time which are necessary to add value to the product."
    - » Shoichiro Toyoda,
      President, Toyota

- Lean and Green = 2 strategies to identify and eliminate non-value-added “stuff”

- The Result = Triple Bottom Line
  - Profit
  - People
  - Planet

- Equipping People
- 2 types of change
  - Technical (no choice)
  - Behavioral (choice)
- Sustainability requires behavioral change
- People are a part of the solution, not treated as objects of change

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- Tools that sustain business (profitability)
  - Lean Manufacturing
    - VSM, 5-S, Cell Flow, TPM, Plant layout, SMED
  - ISO Programs
    - Quality, Environmental, Safety, Energy
  - Top Line Tools
    - Eureka!, Marketing, New Product Development

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- Let's look at LEAN
  - Non-valued added waste ALWAYS has an adverse impact on the environment
    - 8 wastes of lean
    - Waste walk

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History of Manufacturing

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	Pre-industrial 1890	Mass 1920	Lean 1980
People	• Craftsmen perform all aspects of task • Self-taught or apprentice-ship training	• Employees contribute minimally to total product • Training for limited skills • Management makes decisions	• Clusters of employees working in teams • Extensive, continuing training
Product	• Customized, non-standard products • Variation in quality	• Standardized, focused on volume not quality	• Focus on internal/external customer
Work Environment	• Independence, discretion • Variety of skills • Responsibility	• Limited skills and knowledge • Repetitive, mind-numbing work • Little discretion, simplified tasks	• Some discretion, group effectiveness, empowerment, team accountability, work cells

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Reduced Lead Time

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"One of the most noteworthy accomplishments in keeping the price of Ford products low is the gradual shortening of the production cycle. The longer an article is in the process of manufacture and the more it is moved about, the greater is its ultimate cost."

— Henry Ford, 1926

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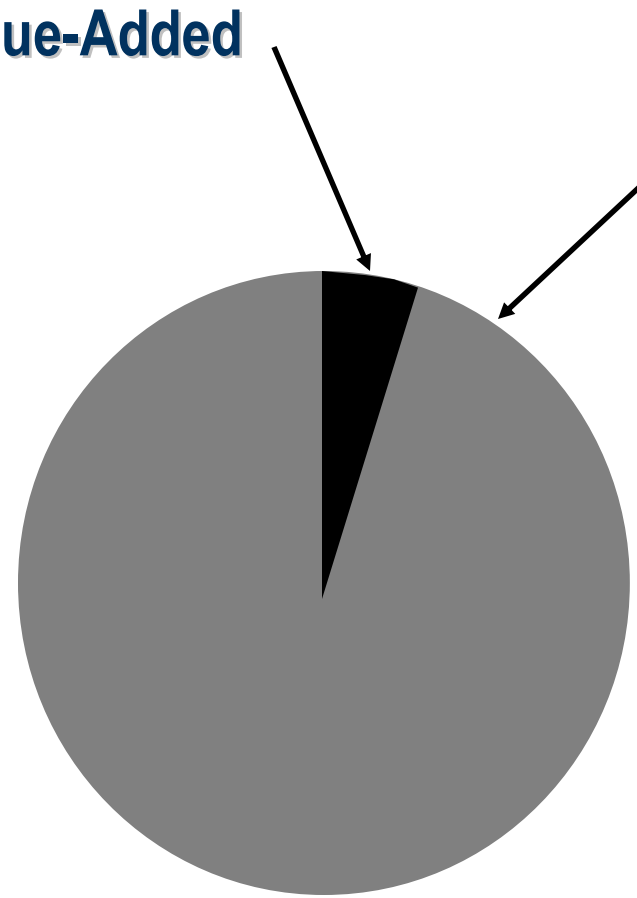

Non-Value-Added

- Overproduction
- Waiting
- Transportation
- Non-value-added processing
- Excess inventory
- Defects
- Excess motion
- Underutilized people

Typically 95% of all lead time is non-value-added.

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Overproduction

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- **Making more than is required by the next process**
- **Making earlier than is required by the next process**
- **Making faster than is required by the next process**
- **Causes of overproduction:**
  - **Just-in-case logic**
  - **Misuse of automation**
  - **Long process setup**
  - **Unlevel scheduling**
  - **Unbalanced workload**
  - **Over engineered**
  - **Redundant inspections**

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Inventory Waste

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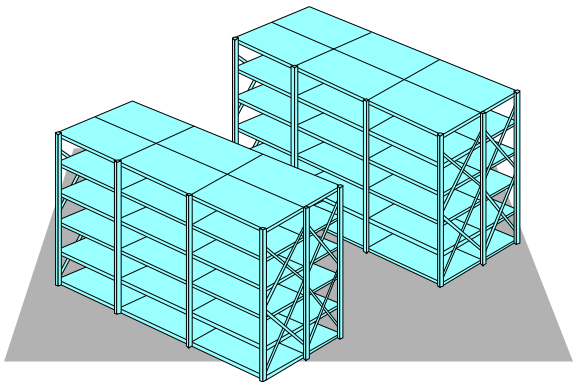
- Any supply in excess of a one-piece flow through your manufacturing process
- Causes of excess inventory:
  - Need for buffer against inefficiencies and unexpected problems
  - Product complexity
  - Unleveled scheduling
  - Poor market forecast
  - Unbalanced workload
  - Misunderstood communications
  - Reward system
  - Unreliable shipments by suppliers



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Defects

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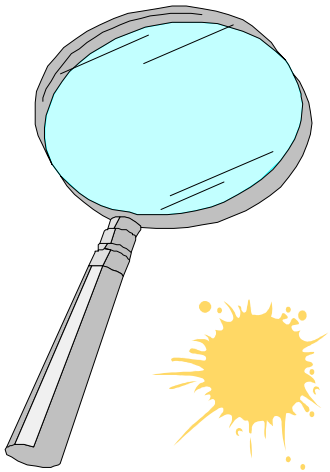
- Inspection and repair of material in inventory
- Causes of defects:
  - Weak process control
  - Poor quality
  - Unbalanced inventory level
  - Deficient planned maintenance
  - Inadequate education, training, or work instructions
  - Product design
  - Customer needs not understood



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Processing Waste

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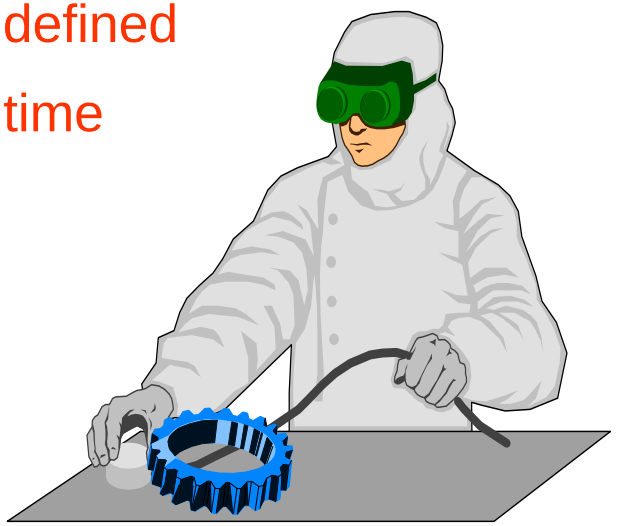
- Effort that adds no value to the product or service from the customers' viewpoint
- Causes of processing waste:
  - Product changes without process changes
  - Just-in-case logic
  - True customer requirements not clearly defined
  - Over-processing to accommodate downtime
  - Lack of communication
  - Redundant approvals
  - Extra copies or excessive information



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Waiting Waste

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- Idle time created when waiting for…?
- Causes of waiting waste:
  - Unbalanced workload
  - Unplanned maintenance
  - Long process setup times
  - Misuses of automation
  - Upstream quality problems
  - Unlevel scheduling

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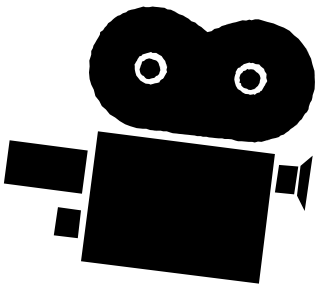
People Waste

- The waste of not using people's mental, creative, and physical abilities
- Causes of people waste:
  - Old guard thinking, politics, the business culture
  - Poor hiring practices
  - Low or no investment in training
  - Low pay, high turnover strategy

Motion Waste

- Any movement of people or machines that does not add value to the product or service
- Causes of motion waste:
  - Poor people or machine effectiveness
  - Inconsistent work methods
  - Unfavorable facility or cell layout
  - Poor workplace organization and housekeeping
  - Extra “busy” movements while waiting



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Transportation Waste

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- Transporting parts and materials around the plant
- Causes of transportation waste:
  - Poor plant layout
  - Poor understanding of the process flow for production
  - Large batch sizes, long lead times, and large storage areas

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- Seeing the GREEN/CLEAN in Lean

- Overproduction
  - Energy usage
    - Electricity, gas, lighting
  - Waste
    - Hazardous, solid waste,
    - damaged WIP
  - Water
    - Discharge

- Waiting
  - Energy usage
    - Heating, cooling, lighting
  - Solid waste
    - Packaging, vending, paperwork
  - Water
    - Cleaning, mopping, sewage

- Transportation
  - Are your recycling containers at point of use?
  - Electricity/Propane for forklifts
  - Electricity/Oil for conveyors
    - What falls off conveyors? (landfill/water)
  - Fork lift inspection is non-value added but necessary – creates paper waste
  - Delivery of compressed air and piping systems (energy)

- Non-value Added Processing
  - Energy for deburring edges
  - Chemical usage and hazardous waste
    - Rust preventive
    - Bleaching
  - Landfill cost for extra packaging
  - Water usage/waste water treatment
    - Energy for pumping systems
  - PAPERWORK!

- Excess Inventory
  - Energy costs in warehouses
    - Heating/cooling/lighting/propane
  - Packaging waste
  - Disposal costs for obsolete/damaged product
  - Hazardous waste for expired chemicals
  - Dunnage/pallets/bins

- Defects
  - If it is made wrong:
    - Increased energy (remelt/rework/idle stoppage)
    - Increased air emissions (rework)
    - Excess motion (inspection/marking/labeling) can create landfilled waste and hazardous waste
    - Propane/electricity for forklifts to move off line

- Excess Motion
  - Accidents/Incidents
  - Point of use storage (right sizing quantities)
    - Less chemical volume
    - Less chance of spillage $$$
    - Less risk management planning
    - Less expiration of chemicals
    - Less waste generation/disposal $$$
    - Less reporting requirements (air) $$$

- Underutilized People
  - Does your EHS person have “lean” skills?
  - Is there someone who reviews energy bills?
  - Do you incorporate “lean” into problem solving and accident investigation teams?
  - Who negotiates recycle/reuse costs?

- Doritos Example

- Lean metrics emphasize product flow
- Environmental costs are traditionally found in “overhead”
  - Waste disposal
  - Energy
  - Air permits
  - Waste water discharge
  - Training

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Lean Building Blocks

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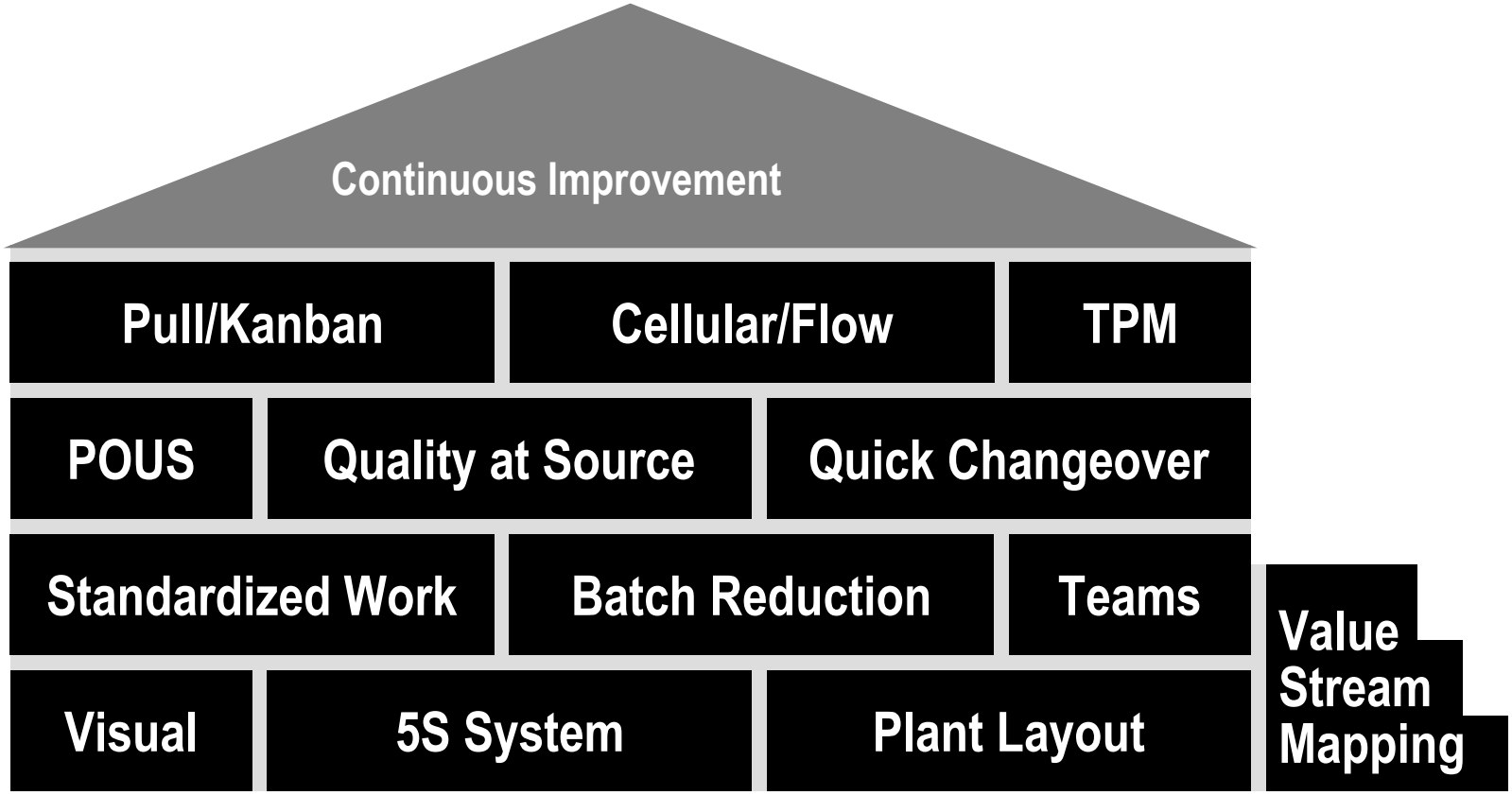

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- Value Stream Mapping Example

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Lean VSM

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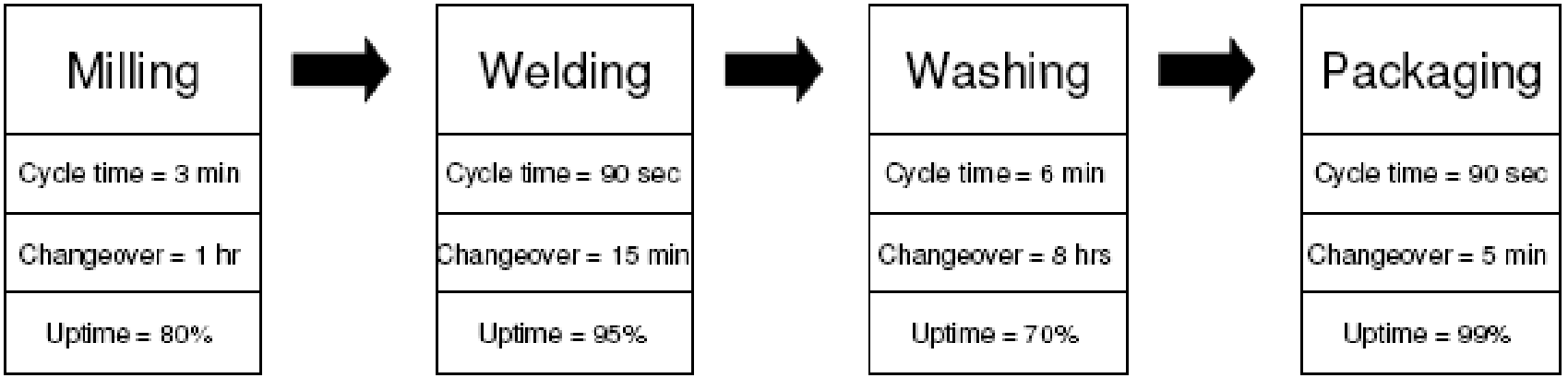
Traditional Lean Value Stream Mapping Looks at:

- Cycle time
- Changeover
- Uptime or Runtime



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CLean VSM

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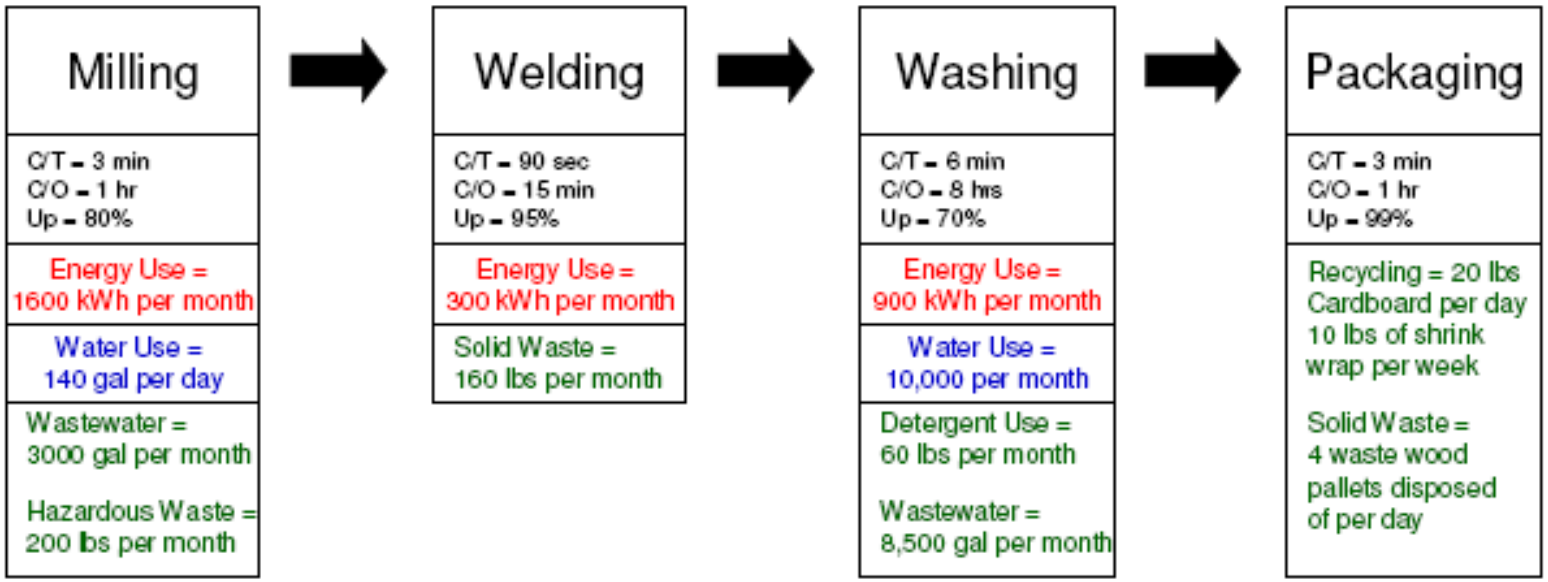
Adding in environmental metrics…



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– Value Stream Mapping
  - Long cycle times affect energy usage
  - How are raw materials being used?
  - How much waste is generated?
  - Information flow can lead to high phone/fax bills or lots of paper waste

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Plant Layout

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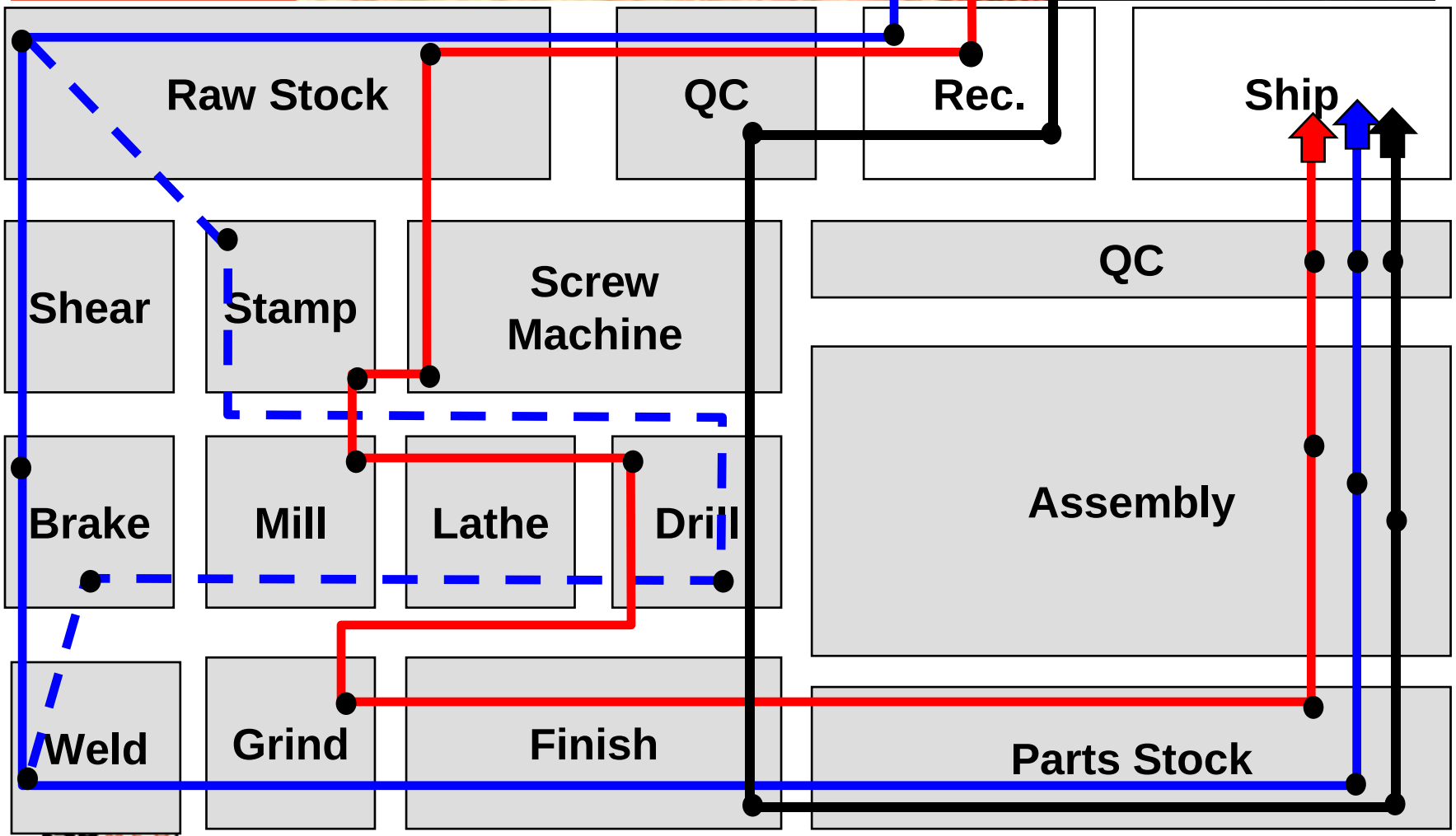

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- Plant Layout
  - Energy
    - How many points of service?
    - Is lighting adequate?
    - Are boilers efficient?
    - Is newer technology being utilized?
    - Can water/heat be recycled/reused?
    - Are compressed air systems optimized?
    - “Spot” lighting can save $

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Work Place Organization

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A safe, clean, neat arrangement of the workplace provides a specific location for everything, and eliminates anything not required.

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Elements of 5S

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Sort — Perform "Sort Through and Sort Out," by placing a red tag on all unneeded items and moving them to a temporary holding area. Within a predetermined time the red tag items are disposed, sold, moved or given away. "When in doubt, throw it out!"

Set in Order — Identify the best location for remaining items, relocate out of place items, set inventory limits, and install temporary location indicators.

Shine — Clean everything, inside and out. Continue to inspect items by cleaning them and to prevent dirt, grime, and contamination from occurring.

Standardize — Create the rules for maintaining and controlling the first three S's and use visual controls.

Sustain — Ensure adherence to the 5S standards through communication, training, and self-discipline.

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– Workplace Organization (5-S)

- Sort generates waste so make sure to prevent future waste
- Set in Order – try to reuse current storage and watch for contamination (oil/dust) on parts and material
- Shine – PREVENT air/oil/water leaks which save on energy and waste costs
- Standardize – standard work should help minimize water, air, electricity, gas, paper, and material use

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Visual Controls

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Simple signals that provide an immediate understanding of a situation or condition. They are efficient, self-regulating, and worker-managed.

Examples:

- Kanban cards
- Color-coded dies, tools, pallets
- Lines on the floor to delineate storage areas, walkways, work areas, etc.
- Andon lights

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Sample Daily Operator PM

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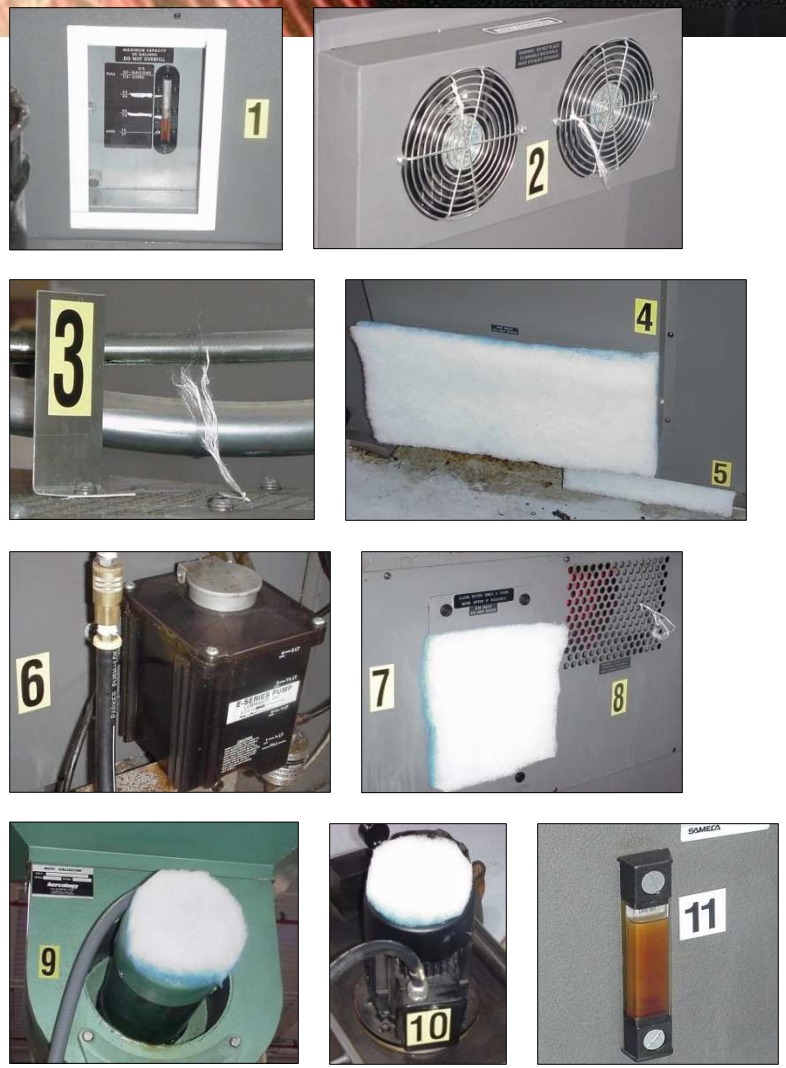
Daily Operator PM

- ☐ 1. Check coolant level through clear Plexiglas
- ☐ 2. Check heat exchanger fans (strings should be moving)
- ☐ 3. Check servo drive fans (string should be moving)
- ☐ 4. Check heat exchanger air filter (change when dark)
- ☐ 5. Check servo drive air filter (change when dark)
- ☐ 6. Check way lube reservoir (add when low)
- ☐ 7. Check main motor air filter (change when dark)



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Quick Changeover

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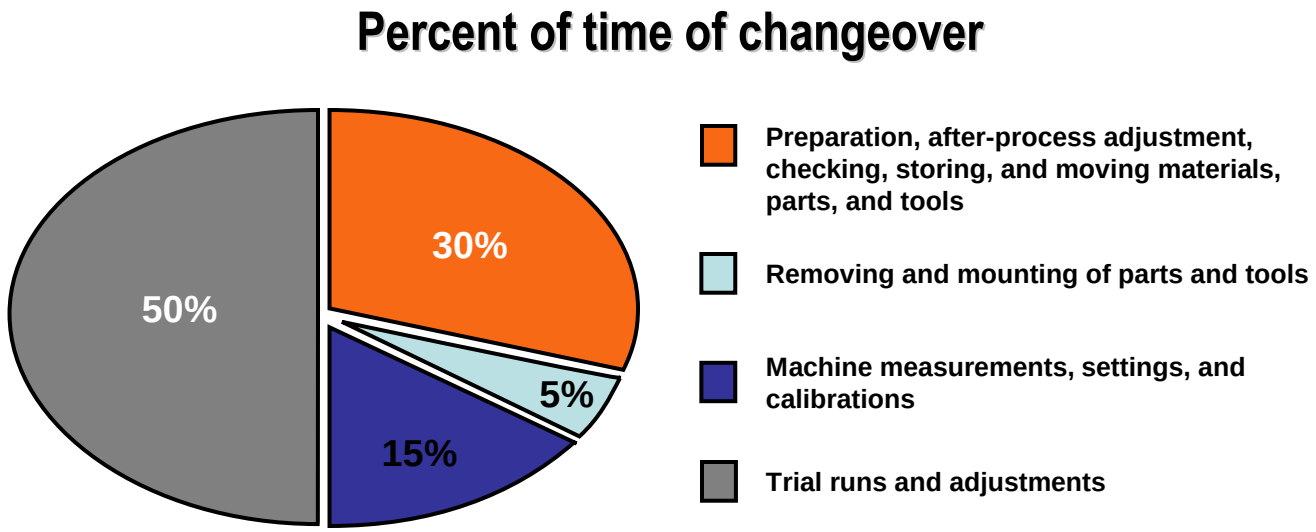
- Definition: The time between the last good piece off the current run and the first good piece off the next run.
- Before Shigeo Shingo's Single Minute Exchange of Die (SMED) improvements, basic setup tasks and related time breakdowns:



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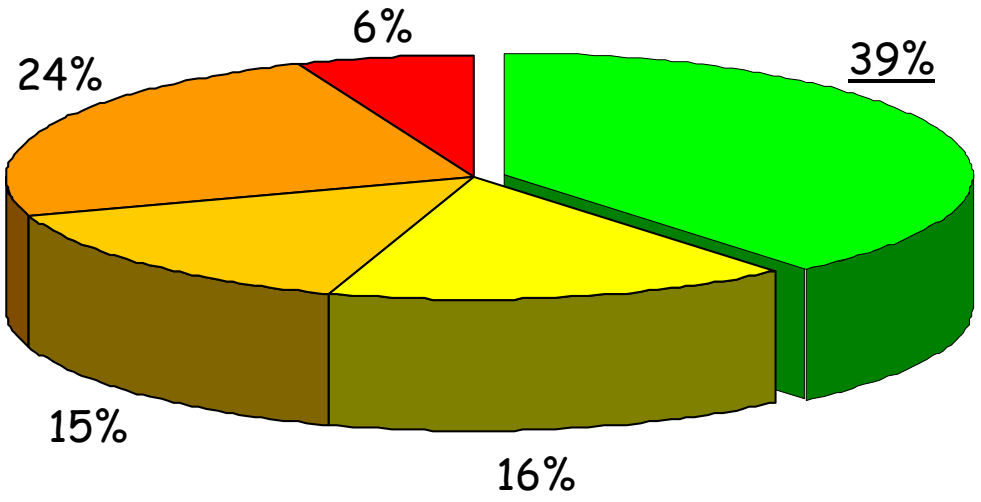
- SMED
  - Reduces electricity and gas use
  - Minimizes spikes in energy which can = $$$
  - Reduces water/chemical use which save on waste costs
- Lean Office
  - Solid waste (paper) reduction
  - Electricity (office lighting/HVAC)

– Total Productive Maintenance (TPM)
  - Reduce compressed air costs
  - Energy fluctuation (idling/stoppages)
  - Keeping things plugged up that don't need to be used or charged all the time = $$$
  - Parts washing generates waste
  - How much water is being used?

Analysis of Major Losses

Typical Example



- Running Time
- Setup and Adjustment
- Breakdowns
- Idling and Minor Stoppages
- Defects and Rework

OEE = 39%, Lost Capacity = 61%

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Batch Size Reduction

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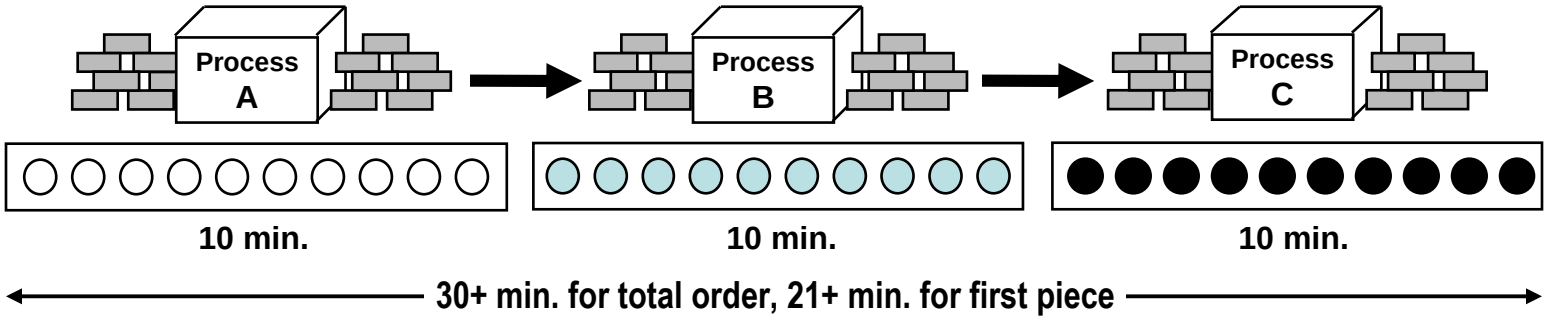
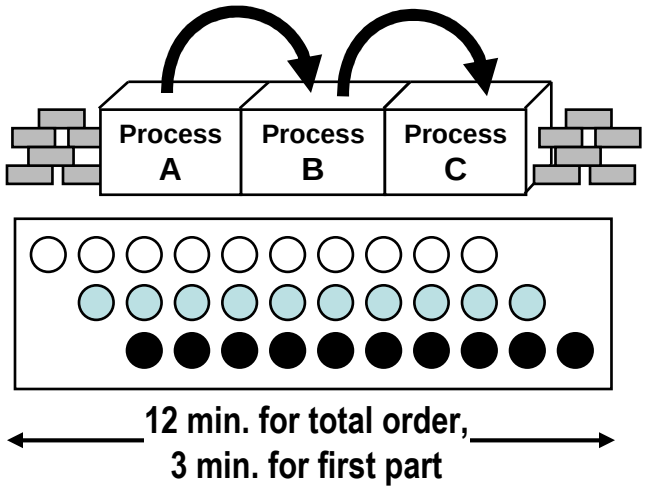
Batch and Queue Processing



Continuous Flow Processing



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Batch Size Reduction

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The best batch size is one piece flow, or: "make one and move one!"

-Environmental savings?

-Energy savings?

-Trade offs!

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Point Of Use Storage

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- Raw material is stored at workstation where used
- Works best if vendor relationship permits frequent, on-time, small shipments
- Simplifies physical inventory tracking, storage, and handling

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- Excess Motion
  - Point of use storage (right sizing quantities)
    - Less chemical volume
    - Less chance of spillage $$$
    - Less risk management planning
    - Less above/below ground tank requirements
    - Less expiration of chemicals
    - Less waste generation/disposal $$$
    - Less reporting requirements (air) $$$

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Quality at the Source

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- Source Inspection: Operators must be certain that the product they are passing to the next work station is of acceptable quality.
- Operators must be given the means to perform inspection at the source, before they pass it along.
- Samples or established standards are visible tools that can be used in the cell for such purposes.
- Process documentation defining quality inspection requirements for each work station may need to be developed.

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Quality at the Source

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- Cleaning up Quality
  - Jigs and visuals…not paperwork
  - Spec materials…not scrap
  - First past yield
  - Write on/Wipe off sheets
  - Signature reduction

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Pull System

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Pull System is a flexible and simple method of controlling or balancing the flow of resources

Eliminating waste of handling, storage, expediting, obsolescence, repair, rework, facilities, equipment, excess inventory (work-in-process and finished)

Pull System consists of:

- Production based on actual consumption
- Small lots
- Low inventories
- Management by sight
- Better communication

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Pull System

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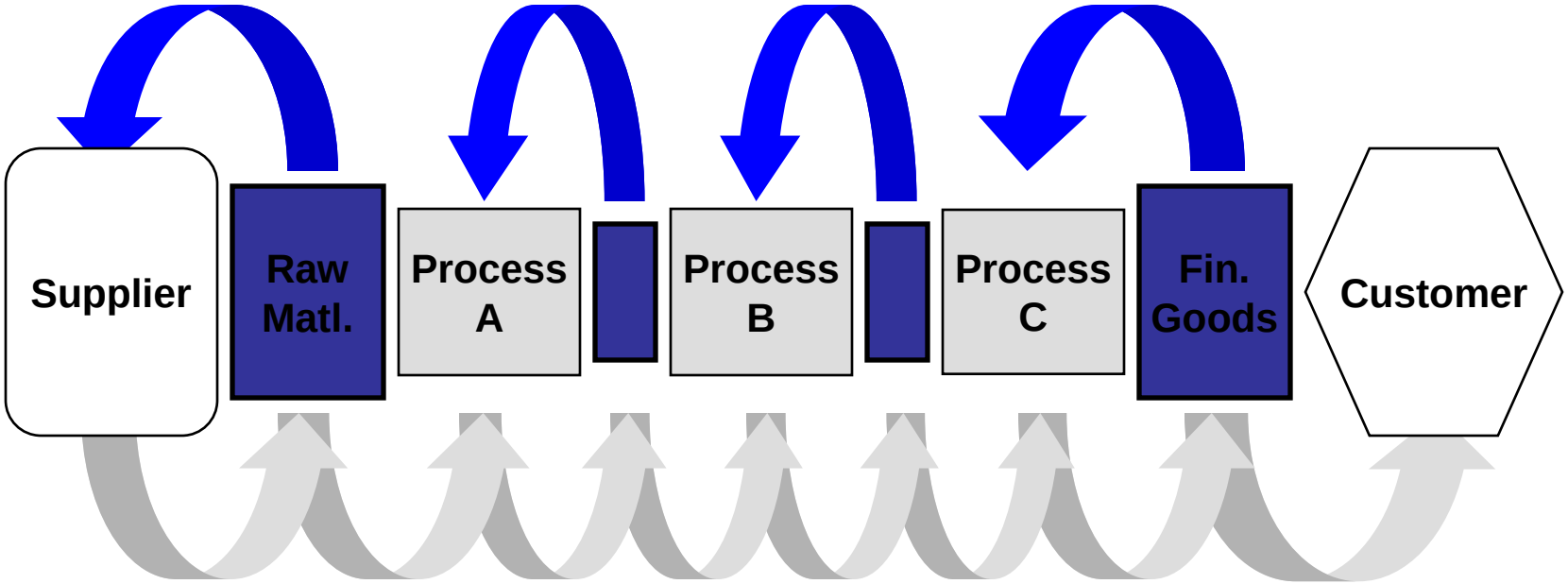

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Cellular Manufacturing

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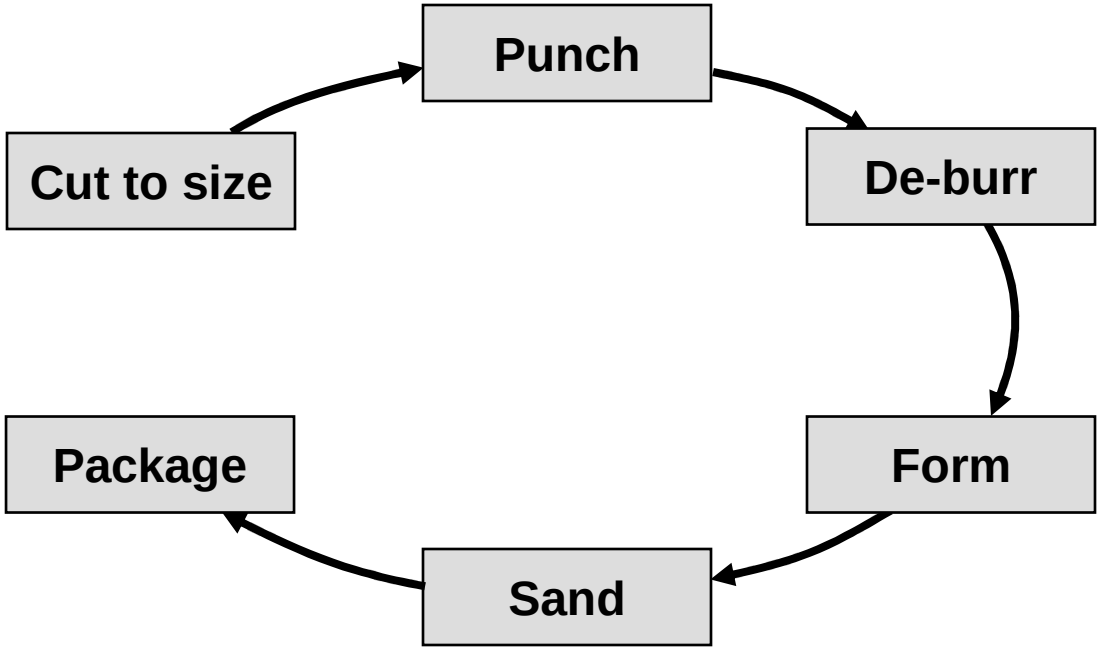
Linking of manual and machine operations into the most efficient combination to maximize value-added content while minimizing waste.



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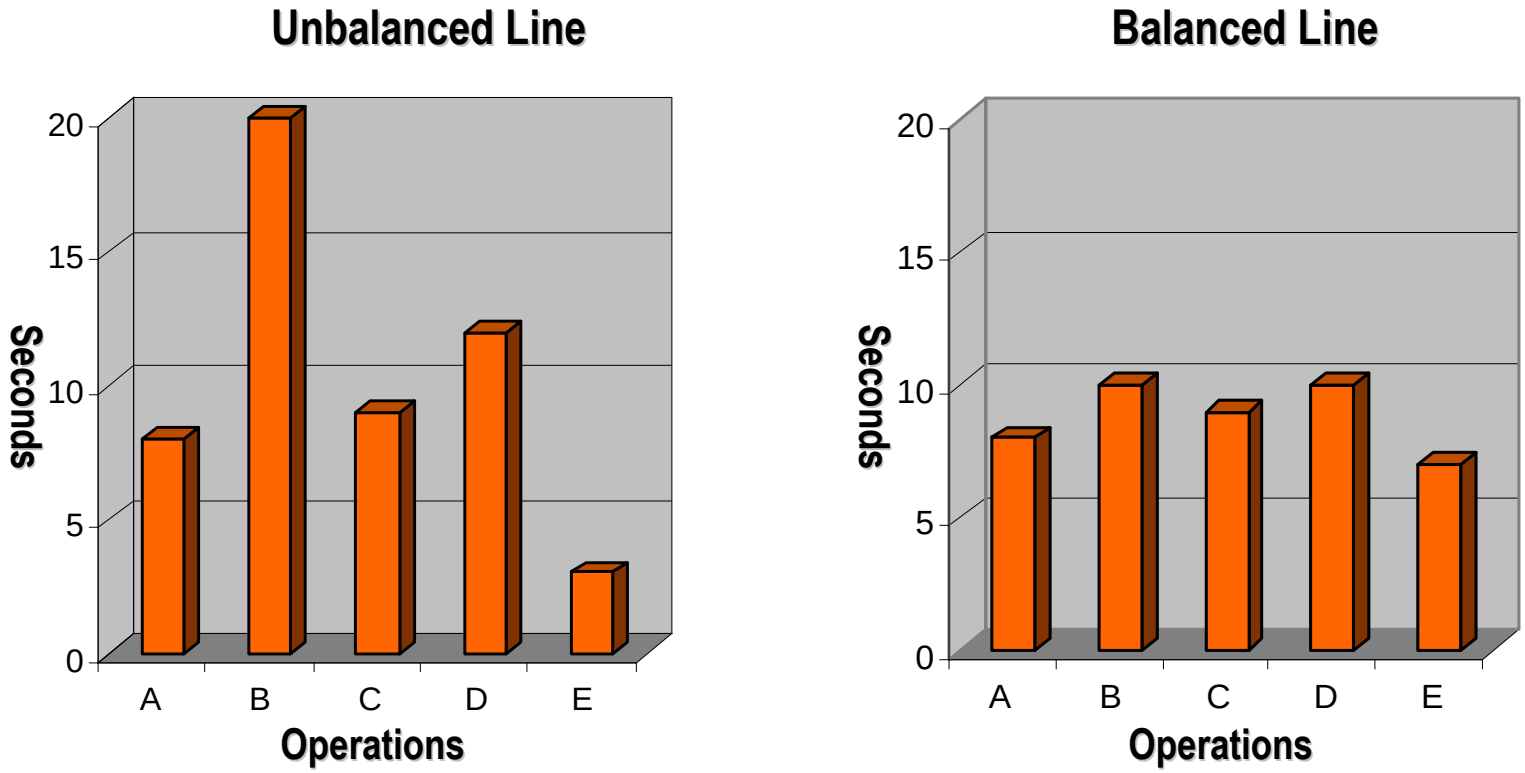
Balance Process



Takt Time = 10 seconds

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Cell Benefits

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- Minimize materials handling
  - Concentrate on value-added motion
  - Establish material replenishment procedure
- Make use of people 100%
  - Promote visibility and flexibility
  - Operators stand for flexibility
- Design goals:
  - Flexible layout
  - Lot size = 1
  - Point of Use Storage (POUS)
  - Visual management
  - Mixed models
- Simplify flow
  - Integrate process operations
  - Materials flow one way

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- Other “Programs” – Standard Work
  - ISO Management Systems
    - Each management system sets goals for improvement which typically have some environmental improvement
  - Six Sigma
    - Most projects quantify energy/waste numbers
  - Safety
    - Spill control, dust control, noise pollution, heat, exposure to chemicals

- Growth Opportunities
  - Eureka! and New Product Development
    - Are there any byproducts that can be used as raw material?
    - At the end life of the product, can the product be remanufactured or reused?
    - Is there a secondary market for off-spec material to reduce rework and the inherent costs or rework?

- The Green Market Advantage
  - "Triple Bottom Line"
    - Economic (Lean/New Products)
    - Environmental (Clean/ISO)
    - Social concerns (Marketing, Jobs, Sustainability)
  - Wal-Mart
  - Disney - Environmentality
  - Green Mountain Coffee

- Case Study Examples
  - Wal-Mart - reduce energy use = more $ for running the same business
  - DuPont – saved $3B from 20 years of carbon reduction emissions
  - BP – getting into solar and wind energy
  - Mercedes & BMW – 100% recycling
  - Sony/Panasonic

- Case Study Example
  - Skylight manufacturer (5-S project)
    - Workplace scan
      - » Forklift traffic for material handling
      - » Propane/Batteries/Wear and Tear
    - Sort/Set in Order
      - » Freed up floor space by removing unnecessary equipment
    - Shine
      - » Leaks – compressed air/hydraulics
  - Annual savings = $230,000

- Equipping People (underutilized?)
- 2 types of change
  - Technical (no choice)
  - Behavioral (choice)
- Sustainability requires behavioral change
- People are a part of the solution, not treated as objects of change

Solutions to improve your bottom line

Green Business

ENERGYSC
SOUTH CAROLINA'S ENERGY RESOURCE

EVERY job is a **GREEN** job:

- **Top Management**
  - Determine operating shifts
  - Number of employees
  - Product mix
- **Mid Level Management**
  - Raw materials
  - Training
  - Scheduling
- **Plant Operators**
  - Throughput
  - Recycling

SC MEP
SOUTH CAROLINA MANUFACTURING EXTENSION PARTNERSHIP

- Call to action
  - What can you do today to take lean to the next level???

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  - www.energysc.org

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